Linear Equation Investigation

by – Ellery Palma

Activity overview:

Students will investigate the idea that numerical information can be represented in multiple ways; numerically, algebraically, and graphically. Students will create an equation, table and graph to represent the same data when given a real-life situation. Given a word problem they will first create an algebraic equation, a table of values, and a scatter plot.

Concepts

Modeling a situation with a variable equation (2-step)
Creating a table of values
Creating a scatter plot
Understanding the definition of a linear relationship

Teacher preparation

Complete the activity; prepare yourself for the discussion that may take place in regards to the equation used, where the values in the numerical table should end and begin as well as the difference between discrete and continuous data in case the question is asked.

Copies of Investigation Packet: Summary and Extension Questions.
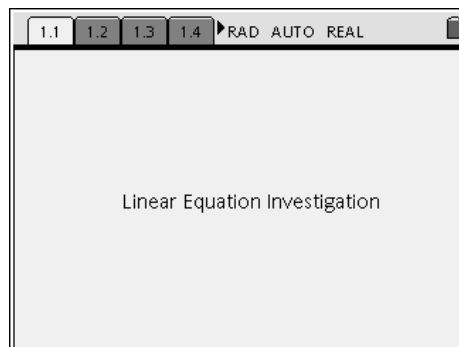
Classroom management tips

I suggest completing this activity as a final assignment for investigating linear equations. There are a lot of concepts that are investigated in this activity. Students should feel comfortable with creating a scatter plot from a table of values. This activity is to be used as a tool that links an equation, table, and scatter plot together in a summary format in regards to a linear relationship.
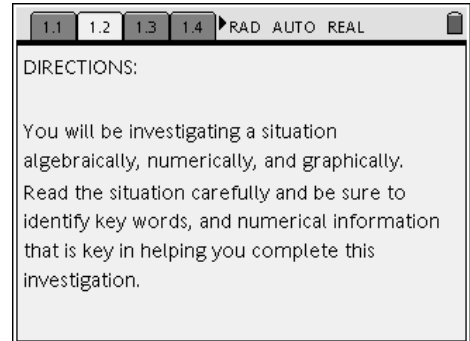
TI-Nspire Applications

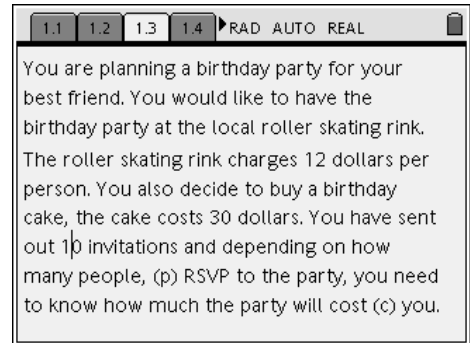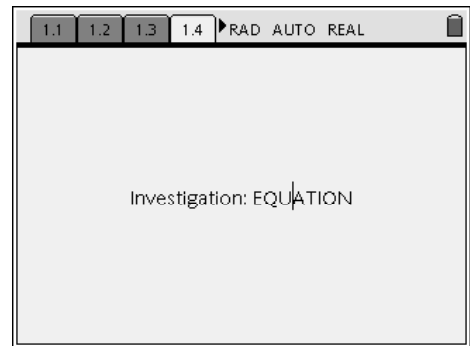*Linear Investigation*

Step-by-step directions

(1.1) Title Page

(1.2)Directions page: Read aloud to the class.

```
1.1  1.2  1.3  1.4  ▶RAD AUTO REAL        ▮
DIRECTIONS:

You will be investigating a situation
algebraically, numerically, and graphically.
Read the situation carefully and be sure to
identify key words, and numerical information
that is key in helping you complete this
investigation.
```

(1.3)Real-life Situation: Read aloud to class.

```
1.1  1.2  1.3  1.4  ▶RAD AUTO REAL        ▮
You are planning a birthday party for your
best friend. You would like to have the
birthday party at the local roller skating rink.
The roller skating rink charges 12 dollars per
person. You also decide to buy a birthday
cake, the cake costs 30 dollars. You have sent
out 10 invitations and depending on how
many people, (p) RSVP to the party, you need
to know how much the party will cost (c) you.
```

(1.4) First Investigation: Creating an Algebraic Equation

```
1.1  1.2  1.3  1.4  ▶RAD AUTO REAL        ▮



            Investigation: EQUATION


```
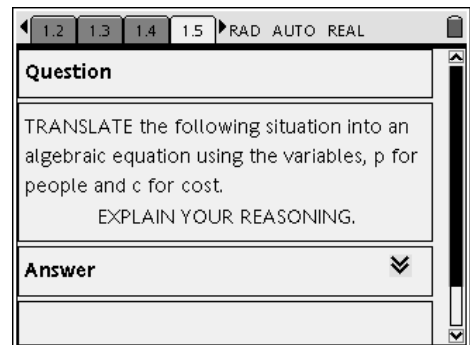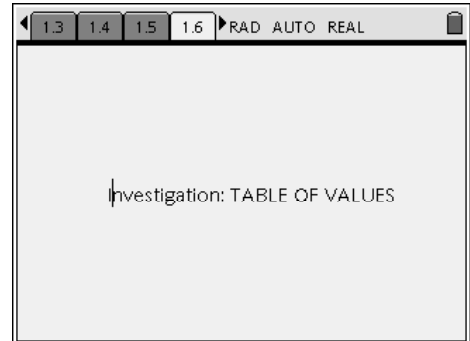
(1.5) Students should be able to create an algebraic
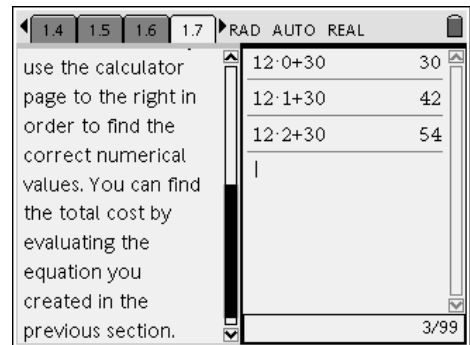   equation using the assigned variables; p and c.

$$c = 12p + 30$$

When explaining the reasoning for the equation students should be able to clearly state that the cost per person is 12. We must multiply 12 by the number of people that attend. The cost of the cake is only a cost that is added on once-not for every person that attends is buying a cake. Therefore 30 is represented as a constant that is being added on once.

```
◀ 1.2  1.3  1.4  1.5  ▶RAD AUTO REAL      ▮
Question                                  ▲

TRANSLATE the following situation into an
algebraic equation using the variables, p for
people and c for cost.
        EXPLAIN YOUR REASONING.

Answer                               ⌄

                                          ▼
```

(1.6) Second Investigation: Creating a Table

```
◀ 1.3  1.4  1.5  1.6 ▶RAD AUTO REAL        🔋




            Investigation: TABLE OF VALUES


```
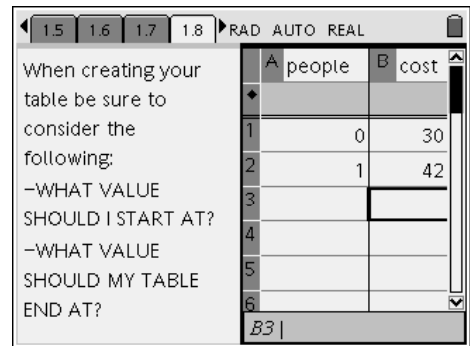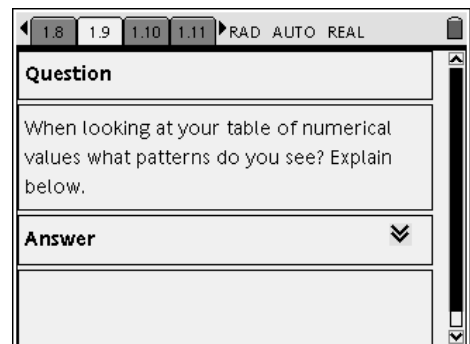
(1.7) Students will begin to calculate the cost of the birthday party for any given number of people that attend the birthday party. They do not have to calculate for the number of people who attend in order. This page is to be used in order to find the values that will be inserted into the table. Examples of the calculation have been provided in the window.

```
◀ 1.4  1.5  1.6  1.7 ▶RAD AUTO REAL        🔋
use the calculator        12·0+30           30
page to the right in      12·1+30           42
order to find the         12·2+30           54
correct numerical
values. You can find      |
the total cost by
evaluating the
equation you
created in the
previous section.                           3/99
```
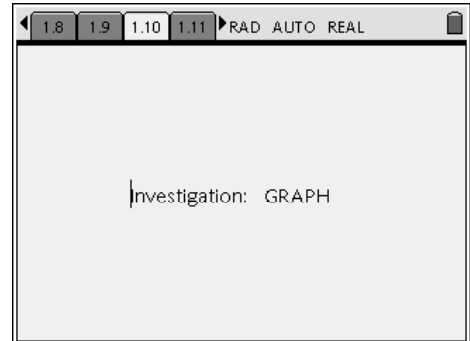
(1.8) When creating the numerical table for this real-life situation it is important to discuss the data that will be included in the table. As in real-life; notice that 10 invitations were sent out; when I created the problem I felt that you did not send an invitation to yourself or to your best friend. Therefore, this is a good opportunity to discuss that the values of 0, 1, 11 and 12 represent.

```
◀ 1.5  1.6  1.7  1.8 ▶RAD AUTO REAL        🔋
When creating your    A people  B cost
table be sure to     ◆
consider the
following:           1          0        30
−WHAT VALUE          2          1        42
SHOULD I START AT?   3
                     4
−WHAT VALUE          5
SHOULD MY TABLE      6
END AT?              B3 |
```
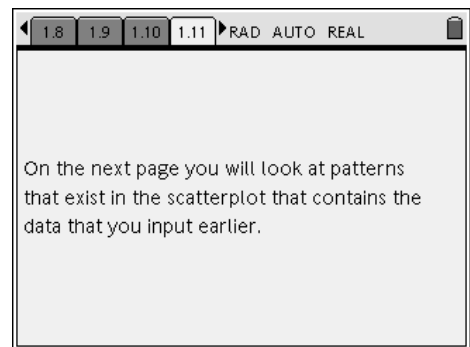
(1.9) Students should be able to recognize that within the numerical table you are beginning with the value of 30 because the cost of the cake is money spent whether you have the party or not. Each interval then increases by 12 because each person will cost 12 per person when attending the birthday party at the roller skating rink.
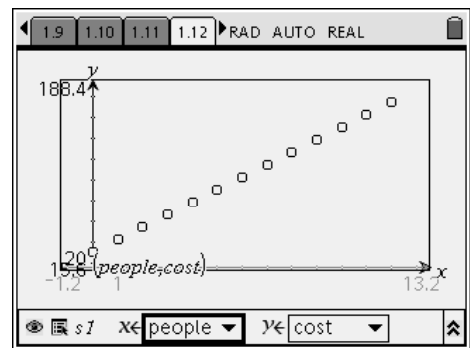
```
◀ 1.8  1.9  1.10 1.11 ▶RAD AUTO REAL       🔋
Question

When looking at your table of numerical
values what patterns do you see? Explain
below.

Answer                               ⌄

```

(1.10) Third Investigation: Creating a Graph

```
◄ 1.8 | 1.9 | 1.10 | 1.11 ▶ RAD AUTO REAL      🔋




            Investigation:  GRAPH



```
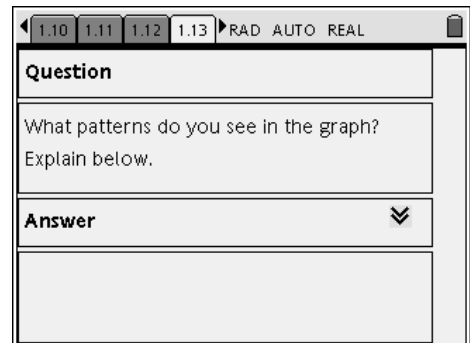
(1.11) Directions of what to expect in the next page

```
◄ 1.8 | 1.9 | 1.10 | 1.11 ▶ RAD AUTO REAL      🔋



On the next page you will look at patterns
that exist in the scatterplot that contains the
data that you input earlier.



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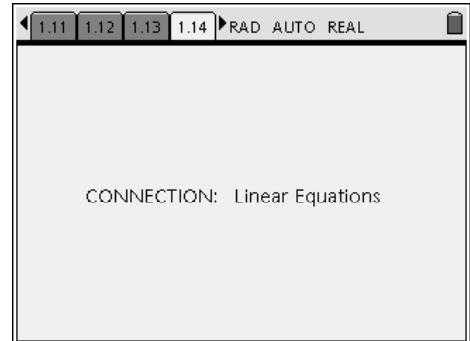
(1.12) The data represented in the graph is created from the numerical table that each of the students input there should be 13 values plotted. (0-12). Students should begin to understand the definition of a linear relationship. Students can also fix any outliers that may exist because of miscalculations. They can simply figure out which is incorrect and go back to the numerical table and "fix" the corresponding values. When creating the scatter plot it is also highly suggested to reinforce and discuss why people has been place in the x-axis and cost in the y-axis.
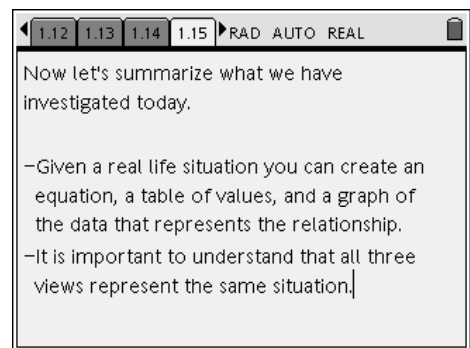
```
◄ 1.9 | 1.10 | 1.11 | 1.12 ▶ RAD AUTO REAL      🔋
         y
 188.4↑                          □
                             □
                         □
                      □        □
                  □
               □
           □
  20↓
-15.8(people,cost)                        →x
 -1.2    1                          13.2

👁 📑 s1   x◄ people ▼   y◄ cost    ▼        ⌃
```

(1.13) Students should be able to recognize that the data that is plotted should be linear.

```
◄ 1.10 | 1.11 | 1.12 | 1.13 ▶ RAD AUTO REAL      🔋
 Question

 What patterns do you see in the graph?
 Explain below.

 Answer                              ⌄


```

(1.14) Summary/Connection of three views of a function.

```
◄ 1.11  1.12  1.13  1.14 ► RAD AUTO REAL        ▯




           CONNECTION:  Linear Equations



```
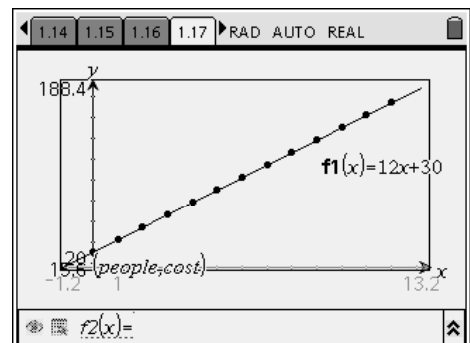
(1.15) Summarization: Students should read this to themselves. There will be a recap of this reading material in the summarization and extension question packet.
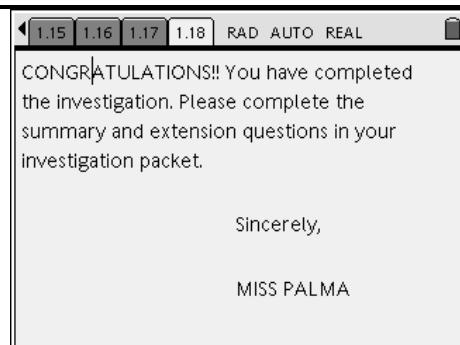
```
◄ 1.12  1.13  1.14  1.15 ► RAD AUTO REAL        ▯
Now let's summarize what we have
investigated today.

–Given a real life situation you can create an
 equation, a table of values, and a graph of
 the data that represents the relationship.
–It is important to understand that all three
 views represent the same situation.
```

(1.16) Students will now look at how closely there equation represents the data that is plotted in their scatter plot. Students should use an equation with an x variable in order to clearly see a continuous line that is plotted within their scatter plot.

```
◄ 1.13  1.14  1.15  1.16 ► RAD AUTO REAL        ▯
Lastly, let's take this investigation one step
further.

  How closely does your algebraic equation
represent the data in your table? On the next
page type in your equation you created at the
beginning of the lesson. This time use the
varible x for your equation.
```
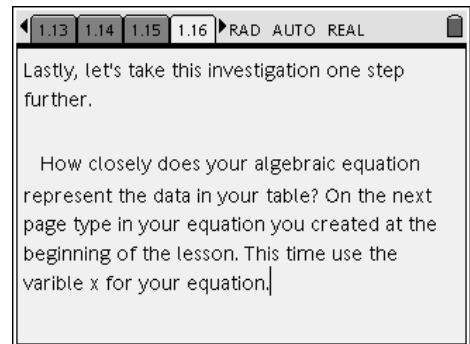
(1.17) By looking at this last page students will then make the connection that this is a linear relationship since the data created within this investigation lies on a straight line.

```
◄ 1.14  1.15  1.16  1.17 ► RAD AUTO REAL        ▯
            y
 186.4↑
                              •
                          •
                       •        f1(x)=12x+30
                     •
                   •
                •
             •
          •
 _28 •(people,cost)                    → x
  _1.2  1                        13.2
◉ ▦  f2(x)=                              ≫
```

(1.18) Students will now complete the extension and summary questions in the investigation packet. This will be assigned for homework and in my case are unable to take their calculators home with them. You will have to change the name in the final page of this activity.

> 1.15 1.16 1.17 1.18   RAD AUTO REAL
>
> CONGRATULATIONS!! You have completed the investigation. Please complete the summary and extension questions in your investigation packet.
>
> Sincerely,
>
> MISS PALMA

Assessment and evaluation:

Students will complete the word document of summary and extension problems.

Activity extensions

Students will complete another real-life situation that reflects the problem investigated in this activity. Students will create each of the follow algebraic, numerical table and graph (sketch) by writing in the packet that is provided to each student.

Student TI-Nspire Document

Linear Investigation.tns

Summary Extension_Linear Equation.doc   (Homework Packet)
Summary Extension_Linear Equation.pdf